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War on Weeds: Winning It for Natural Areas

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War on Weeds: Winning it for Natural Areas An Address

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I am delighted to be here with you today to discuss the rapidly accelerating damage that invasive exotic plants are inflicting on natural areas in this country. This problem may seem overwhelming, but you need not despair because there are economical, realistic, and effective strategies available to meet this challenge.

There are two purposes to this presentation: to give you information you can use to convince others that invasive exotic plants are seriously harmful, and to suggest that we can win this war on invasive exotic plants if we engage enough of the right people.

I would like to begin with a reminder of our basic land management goal to maintain or improve the health of the land. This goal really means striving to have a wide variety of healthy grasses, forbs, shrubs and trees distributed across the landscape. Fortunately, well-managed land is the best defense against the spread of weeds, and the best way to rate the health of a plant community is to determine the percent of exotic species present (Fegler 1998). Unfortunately, when we look at the vast public lands in the West, the greatest obstacle to maintaining healthy plant communities and to the restoration of less than healthy communities is the rapid expansion of invasive weeds. Invasions are easy to recognize in hindsight after they have entered an explosive phase. Unfortunately, by this stage, it is difficult or impossibly expensive to control the increase of the invader (Huenneke 1996). An example is The Nature Conservancy's Altamount Prairie in South Dakota which is so badly infested with leafy spurge (*Euphorbia esula*) that it is no longer regarded as worth managing as native prairie and cannot be sold as cropland (Randall 1996).

I will be showing some ugly pictures of severe weed infestations because I believe they best illustrate the problem and because we need to develop foresight and learn from our experiences. There is absolutely no criticism intended. I will refer to exotic, alien, noxious, invasive, and non-native plants as weeds.

PERMANENT DEGRADATION

There are many exemplary weed management efforts underway by private, county, state, university, and federal organizations. To the credit of many dedicated people, the number of successful restoration projects increases every year. However, the amount of wildland being restored is minuscule compared to the amount of land that needs to be restored. Therefore, the term "permanent" is used because, with today's economics and technology, it is impractical to restore most extensive weed infestations, especially in steep or rocky terrain. Furthermore, extensive weed infestations near trees and shrubs and infestations in riparian areas frequently become permanent because of restrictions on the use some herbicides in those areas.

Let's discuss four examples of extensive land degradation that represent hundreds of others. These examples show how many more wildlands will move into this category of permanent degradation—if we allow that to happen.

In 1938 Clarence Seeley, from the University of Idaho, made his first identification of yellow starthistle (*Centaurea solstitialis*) just north of Lewiston, Idaho. Its danger not recognized then, it now infests hundreds of thousands of hectares in that region including an estimated 30 percent of the BLM land in the Cottonwood Resource Area in Northwest Idaho (L. Wilson, pers. comm. 1994). In 1993 in Oregon, explosions of yellow starthistle were reported with over 40,000 hectares (100,000 acres) in Jackson county, and 80,000 hectares (200,000 acres) in Umatilla County. Now both counties report that those populations have doubled!

In 1970, there were about 13 hectares (thirty-two acres) of leafy spurge in the Theodore Roosevelt National Park in North Dakota. Herbicides were not allowed and now leafy spurge dominates over 1600 hectares (4,000 acres) of the park (Andrascik 1997). There are more than 400,000 hectares (one million acres) of leafy spurge in North Dakota and 240 hectares (600,000 acres) in Montana. Extensive infestations of leafy spurge also continue to spread in Wyoming, Idaho, Colorado and Oregon. From just a few plants in western Idaho in 1954, rush skeletonweed (*Chondrilla juncea*) now infesrs over 1.6 million hectares (four million acres)—"an explosion in slow motion"—now having leapfrogged 160 kilometers (100 miles) to the east, beyond Shoshone, Idaho, and to the west into the Hells Canyon National Recreation Area along the Idaho and Oregon border. Severe infestations of rush skeletonweed are also spreading rapidly in California, Washington and other parts of Oregon.

In the early 1960s perennial pepperweed (*Lepidium latifolium*) began arriving in the Ouray National Wildlife refuge in Utah. Today it dominates about one half of the bottomlands in that refuge (D. Schaad, pers. comm. 2000).

IMPACTS

There are major impacts of invasive weeds to wildlife habitat, watershed health, and endangered species. Studies in Montana show that spotted knapweed (*Centaurea maculosa*) invasions reduced available winter forage for elk (*Cervus* canadensis) 50–80% (Duncan 1997), and in some parts of Theodore Roosevelt National Park in North Dakota, leafy spurge reduced bison (*Bison bison*) forage by 83% and deer (*Odocoileus* sp.) and elk forage by 70% (Stalling 1998).

Habitat in riparian areas is critically important to most wildlife species. Unfortunately, these riparian areas are especially vulnerable to devastation by weeds because of the extra moisture for plant growth and the easy transport of weeds into riparian areas by people, animals, and water. Perennial pepperweed, leafy spurge, Russian knapweed (*Centaurea repens*) and tamarisk (*Tamarix ramosissima*) often form near monocultures in riparian areas and adjacent uplands. Pur-

ple loosestrife (*Lythrum salicaria*) is another exotic that thrives in riparian and wetland habitats. In its native habitat in Europe it only comprises one to four percent of the native vegetation, but in North America densities of up to 80,000 stalks per acre have been recorded (Strefer et al. 1996). Thus, purple loosestrife out-competes native plant species and reduces biodiversity (Nyvall 1995).

Tamarisk, a deep-rooted shrub or small tree, can consume large quantities of water per day relative to the amount used by native species it tends to replace (Zavaleta 2000). Tamarisk commonly draws water levels down so completely that small springs and streams cease flowing. This has a dramatic effect on native vegetation, wildlife, and rare plants. As tamarisk displaces native vegetation, the value of the habitat for animals is markedly diminished.

Fibrous rooted native plants hold soil in place, reduce erosion, promote infiltration and safe release of water, and provide resilience against fire and drought. Many invasive weeds, in contrast, have primarily a tap root that does not have those beneficial characteristics. In a study area in Montana, runoff and sediment yield were 56% and 192% higher, respectively, for areas dominated by spotted knapweed than for native bunch grass vegetation types (Lacey 1989). That increased runoff, early in the season, results in lower summer flows with higher stream temperatures. This higher temperature, coupled with increased sedimentation, degrades water quality and fish habitat.

Numerous studies demonstrate reduced numbers and/or diversity in birds, reptiles, small mammals, and insects in stands of non-native plant species (Huenneke 1996). For example, Ord kangaroo rat (*Dipodomys ordi*) and ground squirrel (*Citellus* sp.) populations were severely reduced on sites infested with Russian knapweed in a study in Wyoming (Johnson et al. 1994).

Research concerning Chukar (*Alectoris chukar*) habitat use and availability in the severely infested lower Salmon River Canyon of Idaho, revealed that chukars selected against (avoided) habitats with higher yellow starthistle ground cover (Lindbloom 1998). Another study showed that when chukar partridge were given free access to all the medusahead (*Taeniatherum caput-medusae*) caryopses (seed) they could eat, along with other dietary requirements, they suffered dramatic losses in body weight (Savage et al. 1969).

In a study at the Morton Arboretum and the Hidden Lake Forest Preserve in Illinois, exotic shrubs appear to be an ecological trap for songbirds. Significantly higher nest mortality to American Robin (*Turdus migratorius*) and Wood Thrushes (*Hylocichla mustelina*) was observed in bush honeysuckle (*Lonicera maackii*) and common buckthorn (*Rhamnus cathartica*), in comparison to mortality in native plants. This is probably due to a combination of sturdy and low branches for nest building, early leaf flush that attracts birds, and the absence of sharp thorns that would otherwise inhibit large mammal predation (Schmidt and Whelan 1999).

The impacts of weeds upon wildlife habitat are not restricted to public lands. For example, in 1988, a 526 hectare (1,300 acre) ranch near Klamath Falls, Oregon, was abandoned due to leafy spurge infestations. The ranch was then purchased at an auction for about 10% of what it would have sold for otherwise (Humphrey 1988).

In the Chicago area where there is an extensive system of preserves, approximately two dozen invasive plant species are currently causing serious and sometimes devastating damage to natural areas. These plants are reducing native plant diversity and associated animal diversity by successfully competing for space, water, sunlight, and nutrients. The spread of these species is recognized as a direct threat to natural communities and to some endangered species. It is arguably the greatest single threat to the integrity of the flora and fauna of the Great Lakes Region (Chicago Wilderness 1999).

The impact to endangered species is significant. In Bureau of Land Management (BLM) managed land there are currently 236 federally listed species, 50 proposed for listing and another 1000 plant and animal species in the sensitive category (Lawton 1999). Using Sage Grouse (*Centrocercus urophasianus*) for example, in nine states having long term data breeding populations have declined by 17–47% from the long term average (Connelly and Braun 1997). Sage Grouse need a wide variety of grasses, forbs and shrubs for foraging and nesting. However, on BLM lands near Idaho Falls, leafy spurge is forming a near monoculture by taking over some critical grouse habitat. In the Stinking Water Mountains near Burns, Oregon, an historic sage-grouse lek (breeding ground) was abandoned after medusahead took over the site.

Another example of impacts to wildlife is the Chinese tallow tree (*Sapium sebiferum*) that continues its rapid spread from North Carolina to Texas with new starts in California. With its capacity for rapid growth and prolific reproduction, the tallow tree is capable of converting native prairies into near monoculture forests in only a few years (Grace 1998). The endangered Attwater's Prairie Chicken (*Tympanuchus cupido attwateri*) in Texas requires open prairie, but unfortunately the tallow tree has already, and continues, to take over much of the Attwater's Prairie Chicken's habitat (M. Williams, pers. comm. 1999). Similarly, the endangered whooping crane needs the open ponds and adjacent uplands on the Aransas National Wildlife Refuge and adjoining lands in Texas. Here again, the tallow tree is invading this critical habitat (T. Stehn, pers. comm. 1999).

Looking at a larger perspective, I do not know of any weed that is all bad. For example, many bird species like tallow seeds. So there is some benefit from this tree. However, regarding insectivorous migratory birds, research shows that there are significantly less insects on tallow than on the native oak. Furthermore, while caterpillars are an important food source for migrant birds, caterpillars cannot be found on the exotic tallow tree. Caterpillars are, however, abundant on native trees and other plants (W. Barrow, pers. comm. 1999). Also, foraging migrant birds, as a group, avoided tallow trees (Barrow et al. 2000). So, while there is some value to the exotic tallow tree, like other invasive exotic plants, it commonly grows into extensive monocultures, especially after fires, floods or hurricanes. Each wildlife species has specific habitat requirements for feeding and cover that are different for different animals. Therefore, instead of monocultures of weeds, the native vegetation must be diverse to support the full wildlife community.

RATE OF SPREAD

Why did I say: "Wildlife habitat in 1000s of public land watersheds is rapidly undergoing the greatest permanent degradation in its recorded history?" It is because so many lands are in the *process* of becoming infested. Wildland weeds increase on average about 14 percent per year. That is an exponential doubling every five years. In one research area in Colorado, dalmation toadflax (*Linaria genistifolia*) increased 1,200 percent over a six year period (Beck 1998). Similarly, field inventory data in the South Fork of the Shoshoni drainage in northwest Wyoming showed that dalmation toadflax increased from 1.6 hectares (four acres) in 1985 to 800 hectares (2,000 acres) in 1997 (Christy 1998). These data are supported by observations of BLM employees in Prineville, Oregon, who for many years have taken a management trip during the first week in June through wilderness study areas along the Lower John Day River. In 1996, they returned from the trip reporting that the dalmation toadflax populations had doubled in size from 1995. Following their 1997 trip, they reported that the toadflax had doubled in size again.

Detection surveys in the Renne watershed on BLM land near Worland, Wyoming, show that hoary cress (*Cardaria draba*) increased from 5.6 hectares (14 acres) in 1990 to 800 hectares (2,000 acres) in 1995 (Christy 1998). Similarly, in the Keating Valley of eastern

Oregon, hoary cress was confined to very small patches in the farmland 15 years ago. Today hoary cress extensively dominates nearby critical deer winter range on BLM lands.

There were only minor populations of spotted knapweed in Montana in 1920. Today, there are about two million hectares (five million acres) with another 12 hectares (29 million acres) of highly susceptible land in that state alone (Duncan 1997). Spotted knapweed is also expanding rapidly in Wyoming, Idaho, Colorado, Oregon and California.

Invasive weeds are a major issue in the Interior Columbia Basin Ecosystem Management Project Draft Environmental Impact Statements (EISs). Many scientists worked on those documents that cover portions of seven states. Quoting from one EIS: "Weeds are spreading rapidly, and in some cases exponentially, in every cluster and sixty-six percent of the BLM/FS lands are susceptible to knapweed and yellow starthistle" (USDA/USDI 1997). And, sixteen years ago, yellow starthistle infested about 400 hectares (one million acres) of private and public land in California. Today, population estimates range up to six million hectares (fifteen million acres) (R. O'Connel, pers. comm. 1998).

A study on the Middlefork Savanna Forest Preserve in Illinois showed that common buckthorn increased about 650 percent between 1986 and 1996 (Bowles et al. 1996). Considering a broader view of this region, in eastern North America, garlic mustard (*Allaria petiolata*) increased exponentially between 1929 and 1989, with the number of new occurrences approximately doubling every 20 years (Nuzzo 1993).

These examples may seem like a lesson in history. However, this massive habitat degradation will only accelerate in the future if we allow that to happen. Like human populations, weeds typically increase exponentially, beginning slowly, then doubling and redoubling (Kummerow 1992).

FIRE AND RATE OF SPREAD

Weed populations can flourish following fire. Wildland fire is a natural process that often helps to maintain or improve the health and productivity of native plant communities. I fully support appropriate prescribed fire. However, when exotic plants are involved, fires burn in an unnatural situation and weeds commonly explode following fire. Fortunately, there is usually a unique window of opportunity to control the weeds following fire and before "seed set" because weeds are especially vulnerable to control at that time.

In a research example from northern Utah, wildfire increased squarrose knapweed (*Centaurea virgata*) abundance by 50 to 120 percent within just two years. Control of squarrose knapweed by applying herbicide in the first fall after a summer burn was 98–100% effective, while the same herbicide treatment achieved only 20% control or less in adjacent non-burned areas. Not only did this study show that invasive weeds can increase dramatically after a fire; but it also shows that post-fire herbicide application is a unique window of opportunity for effective control (Dewey et al. 2000).

Here are some examples of post-fire weed increase:

Near Tintic Junction and Perry, Utah, pictures of fire line contrasts between burned and unburned areas make it obvious that when squarrose knapweed or Dyer's woad (*Isatis tinctoria*) are a minor component of a plant community those weed populations often explode after fire. When Pat Fosse, with the BLM in the Fillmore (Utah) Field Office, studied the nine major weed infestations in her area of responsibility, she found that all of those weed infestations are in areas that have burned recently.

In the Sellway Bitteroot Wilderness in Idaho and Montana, spotted knapweed frequently becomes the dominant plant after fires (D. Dailey, pers. comm. 1993).

Dalmation toadflax exploded recently after wildfires in parts of Yellowstone National Park. Similarly, a few musk thistle (*Carduus nutans*) plants were noticed in 1995 in a woodcutting area on BLM land near Montrose, Colorado. Following a wildfire in 1996, musk thistle populations now form near monocultures over large areas.

Where there were only a few plants of hoary cress in 1996 before the Broken Back fire on BLM land near Worland, Wyoming, there is now a major population of this noxious weed (Christy 1998).

Accelerated by wildfire, yellow starthistle now infests about 25% of the Forest Service Ishi Wilderness in northern California.

In the BLM Sand Butte and adjoining Wilderness Study Areas in Idaho, considerable weed surveillance and effective control of leafy spurge had been underway for many years. Until a huge wildfire burned over the area in 1992, rush skeletonweed infestations were not known to exist there. In 1995, a few rush skeletonweed plants were found and controlled. In 1996 the entire area burned again. A detection survey in 1997 found serious rush skeletonweed infestations scattered within a 24,000 hectares (60,000 acre area).

One indication of how these weeds can be so competitive after fire is shown in a series of pictures of squarrose knapweed, diffuse knapweed (*Centaurea diffusa*) and rush skeletonweed sprouting and setting seed within five to eight weeks after fires. These weeds promptly produced their second crop of seeds while all other plants were dormant, awaiting another season to arrive.

SONORAN DESERT

The unique disaster unfolding in the Sonoran Desert deserves special mention because unprecedented and unnatural wildfires are destroying native plant communities. Within the last eight years, destructive wildfires have consumed large tracts of some of the most scenic and species-rich parts of the desert. Red brome (*Bromus rubens*), an exotic annual grass, grows in dense stands providing abundant fuel between the widely-spaced native plants. Red brome grows back more vigorously after fire, and with more red brome, there's more fire, an accelerating self-perpetuating fire cycle (Schwalbe, in review). Even though some plants resprout, populations of most native perennial plants are catastrophically reduced or eliminated, especially after repeat fires. Many mature saguaro cacti (*Cereus giganteus*) and most young saguaros are often killed with a single fire. Smaller cacti such as pincushions (*Mammillaria microcarpa*), hedgehogs (*Echinocereus engelmannii*), prickly pear (*Opuntia basilaris*), and all species of cholla (*Opuntia* sp.), and palo verde trees (*Cercidium* sp.) are also usually killed. While the damage from red brome (and to a lesser degree other non-native grasses) is already exrensive and some landscapes are permanently altered, this is only the beginning of the degradation that is set to occur on a grand scale (Asher 1999). Experts in Sonoran desert ecology have this to say:

"In the Sonoran Desert, many species of perennials that are burned are unable to resprout from underground parts following fire" (McAuliffe 1997).

"Perhaps the most serious problem created by the spread of exotic annuals has been the resultant increase in fine fuel and fire frequency, particularly in arid regions" (Schmid and Rogers 1988).

"At several locations in the Sonoran Desert, fires accidently ignited by motorists have eliminated saguaro and many other desert perennials over large tracts adjacent to roads" (Rogers 1985).

"Wildfires in Arizona's upland Sonoran Desert have increased dramatically in size and number. In the past 25 years, about 30 percent of the saguaro-shrub vegetation has burned on the Mesa District of the Tonto National Forest. Many saguaros of all sizes have been damaged or killed by these wildfires. Lightning-set fires are generally put out by the storms that bring lightning into the desert. These fires damage a relatively small area. But, when human caused fires

burn saguaro lands they are often a bigger problem. Saguaros are losing the habitat where they live because of the accelerated destruction by humans" (Wilson et al. 1999).

"The propensity of dried red brome to carry fires may lead to the elimination of much of our Sonoran Desert as we know it" (Haughey 1997).

There are many serious biological threats to the Sonoran Desert, but by far the greatest is the clear potential for red brome (and other exotic grasses) infestations and the resultant wildfires to transform much of this desert into vast wastelands with minimal wildlife habitat value. Of the four deserts in North America, the Sonoran Desert is by far the richest in number of life forms and in variety and development of plant communities (Shreve and Wiggins 1964). The danger to this biotic treasure, so cherished by the American public, is imminent. All one needs to do is look north in the Great Basin where cheatgrass (*Bromus tectorum*) invasions (a close relative of red brome) are blamed for about 688,000 hectares (1.7 million acres) of wildfire in 1999 (USDI 1999).

Unlike most of the other seriously invasive weeds, we don't know how to control the spread of red brome in wildlands. Therefore, there is an imperative and an immediate need for a major research symposium, tapping the best minds in the world, to develop prevention and control strategies. Such a symposium should be sponsored by an organization capable of ensuring significant and long term funding for this complex research.

URGENCY

Looking at the big picture, the Departments of Agriculture in eleven western states estimates that there are about 28 million hectares (70 million acres) of invasive exotic weeds on private, state and federal wildlands. This means there are 28 million hectares (70 million acres) of weed seed being produced every year, much of it being carried to other wildlands by wind, water, wildlife, livestock, people and equipment. Consequently, just as predictably as lightning strikes every year, anywhere, almost all public lands are potentially under attack from these weed seeds. Therefore, we need to look beyond known weed infestations and cooperatively keep a vigilant watch on all lands that are susceptible to weed invasion.

How urgent is it to control weeds, especially small infestations? First, we need to remember that, unique among environmental degradation problems, weeds are self-multiplying. They don't stop at some point like wildfire, nor do they deteriorate over time like chemicals. Second, severe and extensive weed infestations begin with just a few plants. Therefore, the thousands of small and/or new infestations currently growing out of control on relatively uninfested land, truly constitute a state of biological emergency.

SOLUTIONS

With big game, bird, fish and endangered species habitat undergoing rapid, accelerating and often permanent degradation from weed infestations, on a grand scale, what are the solutions? The magnitude of this problem can leave one feeling overwhelmed. But, if we had just discussed wildlife management, or recreation management, everywhere, all at once, like we just discussed weeds, we would also feel overwhelmed. However, at the local watershed level where someone is responsible for every piece of land, cooperative weed management can be a reasonable, effective and rewarding endeavor. About 90% of the 142 million hectares (350 million acres) of western public lands, are not significantly infested, yet. And, there is a readily available, effective and widely accepted strategy called Integrated Weed Management that includes: prevention, education, detection, control, restoration and monitoring. However, to be effective, cooperation among all landowners, user groups and agencies is critical. That is why cooperative weed management areas are so urgently needed in so many landscapes. A county, state and federal effort produced the Guidelines for Coordinated Weed Management: Development of Weed Management Areas (1999) (Available from regional Forest Service and state BLM Offices). These guidelines can help people learn how to initiate and implement cooperative weed management areas.

The biggest key to winning the war on weeds is to put top priority on keeping relatively uninfested land from becoming seriously infested. In conjunction with all the other Integrated Weed Management Strategies, this is an effective, economical and realistic approach. Together we can do this all over the country, but we must engage enough of the right people to at least be planning to win this war with a campaign commensurate to the threat. For this to happen our sense of urgency must escalate dramatically. More specifically, thinking about the organizations represented here today, I have some proposals for you to consider: 1.) Make exotic plant management one of your top organizational priorities, 2.) Designate a lead person at all levels of your organization to develop policy, funding, and to weave weed management into every day activities, 3.) Make weed management a top priority habitat management responsibility for wildlife biologists along with forestry, botany, fire, wilderness, recreation, range management and law enforcement people.

Here are just three examples of what would surely happen "on the ground" if you implement these three suggestions along with other ideas you may have:

First, in 1992 Dave Weber, habitat biologist for the Colorado Division of Wildlife (CDOW), began cooperatively attacking purple loosestrife infestations in the Denver area. In cooperation with numerous local governments, Weber provided the leadership for detection surveys and fairly comprehensive control work every year in three drainages. As a result, in 1998, in 31 of the 130 original sites, purple loosestrife can no longer be found. On the remaining ninety-nine sites the seed heads are being cut and purple loosestrife is being controlled. Consequently, there has been a drastic reduction in the amount of loosestrife seeds floating out of the Denver area. Furthermore, Dave publishes the "CDOW Weed News", and he is a key organizer of the Colorado Weed Network.

Second, every year in the Carrizo Gorge Wilderness in southern California, Tim Finger, BLM wilderness coordinator, leads a group of Sierra Club volunteers and Civilian Conservation Corps workers to search out and remove tamarisk. The tamarisk dries up water in small streams and springs. The water that is critical to the threatened Peninsula bighorn sheep (*Ovis canadensis*), frequently flows again following removal of tamarisk.

Third, giant reed (*Arundo donax*) continues to take over habitat for endangered fish and birds in southern California. Research shows that the total number of insects, total insect biomass and taxonomic richness of invertebrates associated with giant reed are significantly lower than that associated with native vegetation (Herrera 1997). Furthermore, giant reed uses about three times as much water as the native plants, introduces an unnatural fire cycle into the ecosystem, and easily replaces entire plant communities (Iverson 1993, Bell 1994, Reiger and Kreager 1989). Shawna Bautista, wildlife biologist on the Angeles National Forest, initiated and secured outside funding and now coordinates many giant reed control projects. Thanks to Bautista, pictures show the dead reed with native willows (*Salix* sp.) returning naturally.

These three people view weed management as a critical part of their habitat management responsibility. These examples show what can happen in thousands of other places all around the country if high priority is given to weed management and if wildlife biologists, along with other specialists, see weed management as one of their top priority responsibilities, to protect and enhance wildlife habitat.

I urge you to act quickly and decisively while we still have the opportunity to prevent natural areas in so many parts of the country, from entering that category of permanently degraded.

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